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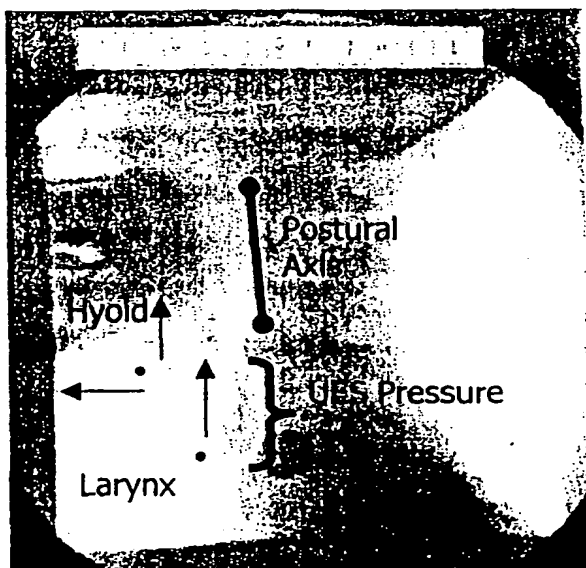
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(54) Title: METHODS AND DEVICES FOR INTRAMUSCULAR STIMULATION OF UPPER AIRWAY AND SWALLOWING MUSCLE GROUPS



(57) Abstract: Devices and methods were discovered that successfully provided patient autonomous control of both hyolaryngeal elevation, anterior hyoid motion and opening of the upper esophageal sphincter for swallowing by intramuscular stimulation of two muscles. The technology allows patient self stimulation of swallowing and can return oral feeding to dysphagia patients. Indwelling electrode stimulation of only two muscles generated as much as 80 % of normal synergistic movement leading to swallowing. The devices and methods also are useful for control of other upper respiratory muscle groups involved in speech and voice. Calibration techniques may be used in combination for greater freedom in setting and using electrodes over extended implantation time periods. These methods and devices can control complex movements of body solids such as bone and cartilage and tissues by electro stimulation of a minimum set of muscles simultaneously.